Volunteered Geographic Information (VGI) for Disaster Management: A Case Study for Floods in Jakarta

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Introduction

The use of Geographic Information Systems (GIS) is considered as one of the important information and communication technology (ICT) tools for disaster management (Reinhardt 2014). GIS are able to enhance the management of disasters and emergencies to reduce risks associated with this type of events (Cutter, 2003). Using GIS for disaster management can be challenging as the required data might be difficult to acquire, obsolete or non-existent (Cutter 2003; ESRI et al. 2000). Due to the uncertain nature of disaster events, it is important to acquire and use relevant data in order to deliver information as soon as possible (Roche et al. 2013).

Volunteered Geographic Information (VGI) is a potential solution to the data challenge as non-experts can create and provide geographic information from Global Positioning Systems (GPS), mapping software, and other technologies (Goodchild 2007a). The characteristics of VGI data are different than authoritative data due to the diversity of the contributing citizens as data producers and their reasons or aims behind their involvement (Sui et al. 2013). VGI is also closely related to the concept of crowdsourcing (Howe 2010). VGI activities are supported by the internet technologies as a platform to acquire and host the geographic information offered by anyone (Foody et al. 2013). Some examples include OpenStreetMap (OSM), Geonames, and Google Map Maker.

VGI is widely used during disaster response, e.g. during the 2010 earthquake response in Haiti (Haklay et al. 2014; Meier 2012), in 2013 for typhoon Haiyan in the Philippines (Haklay et al. 2014), and in 2013 for floods in Canada (Schnebele et al. 2014). Disasters create a time-critical need for geographic information and VGI can address this need with near real-time information (Goodchild and Glennon 2010). The collected geographic information from the VGI process has been useful during the immediate emergency response when emergency responders demand geographic information to ensure the needs of victims are met and resources are allocated appropriately. Beyond the immediate response and recovery stages in disaster management (Fig. 1), there is a lack of research in the application of VGI to the other two stages of the disaster management cycle, mitigation and preparedness (Haworth and Bruce 2015).

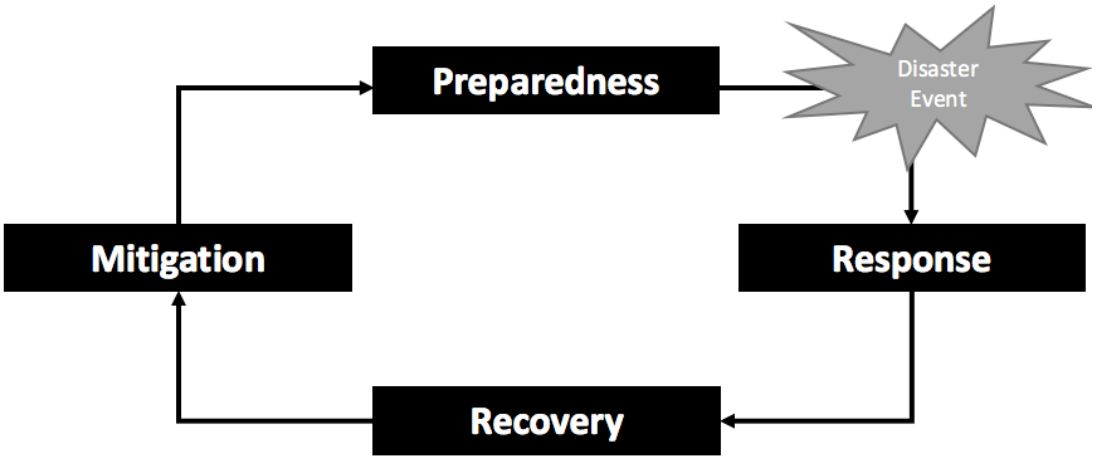

Figure 1. Disaster management cycle (National Research et al. 2006; Khan et al. 2008; BNPB 2008a).

Compared to authoritative data, VGI has major credibility issues as data can be created by anyone regardless of their expertise (Foody et al. 2013; Schnebele et al. 2014; Goodchild and Glennon 2010; Haworth and Bruce 2015). From a VGI perspective, credibility is closely related to trustworthiness dimension (e.g. reputation, reliability, trust) and expertise dimension (e.g. quality, accuracy, authority, competence) (Flanagin and Metzger 2008).

Jakarta, the largest city and the capital of Indonesia, has a major flooding problem. The floods have a major impact on the city, threatening a population of 10 million (Jakarta 2014). VGI has been used within disaster management cycle in Jakarta (Haklay et al. 2014, 2012; Holderness and Turpin 2015). To utilise VGI in disaster management, a framework is required to improve VGI's credibility, enhancing its data quality and accessibility (Fazeli et al. 2015).

This paper will present the preliminary findings of a Master thesis research project in Geographic Information Science (MGIS). These findings explore the current and potential uses of VGI across all four stages of the disaster management for floods in Jakarta, including their benefits and credibility related issues. The analysis of the above results will directly contribute to developing a framework for improving VGI's credibility for disaster management, focussing on floods in Jakarta.

Methodology

Data Collection

The research detailed in this paper will use several qualitative techniques for data collection as follows:

1) A structured interview method to gather evidence about the current state, opinions, and future directions of VGI use in disaster management. Participants are selected according to their involvement within VGI and disaster management domain in Jakarta and will be drawn from three different sectors: *government, non-government or private,* and *academic*.

2) A focus group to gain knowledge about the current characteristics of user's contribution for VGI, such as trust for VGI-derived information and willingness to participate. A small number of VGI contributors are selected from Marunda, a village in North Jakarta which is affected by the flood several times.

These interviews and focus group will be capturing opinions from individuals working in the public and private sector and from individual citizen contributors about current use of VGI for flood management in Jakarta, including potential means to mitigate identified credibility issues.

Data Analysis

Transcripts from the interviews and focus group will be analysed using thematic analysis. Thematic analysis is beneficial in this research because it can capture complex meanings within textual data sets (Guest et al. 2012). Figure 2 below shows the three stages of thematic analysis process used in this research. NVivo software package is used as the analysis tool.

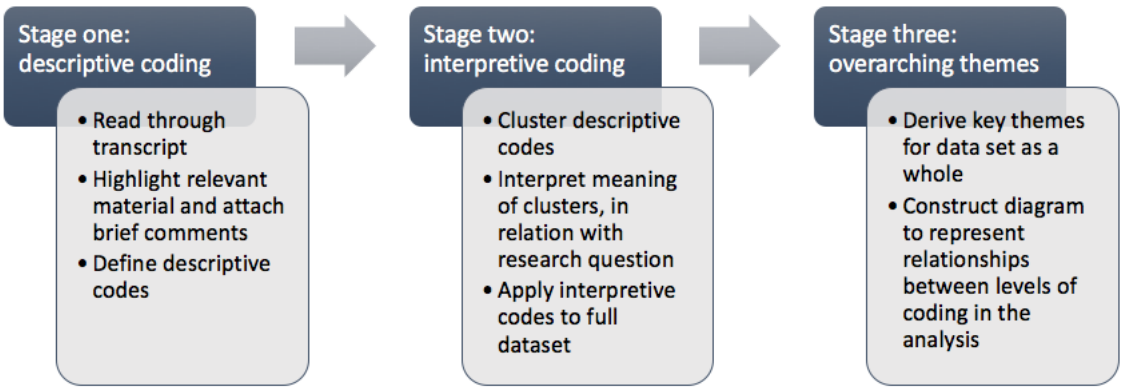

Figure 2. Thematic analysis (King and Horrocks 2010).

Limitations

Due to the time constraints and budget limitations, there are potential influences which might affect the result of this research:

1) The study area is limited to Jakarta province and only flood disasters are addressed.
2) It is not possible to establish a large pool of interviewees and communities for the focus group. The selected interviewees and community, however, provide strong coverage of disaster management practices and the influence of VGI in Jakarta.
3) Bahasa Indonesia will be used as the main communication language (except with overseas respondents) because English is not the first language in Indonesia. Accurate translation is a time-consuming process which might affect the research timeframe. Thus, a professional translation service will be used for translating the research documentation (e.g. notes, interview transcript) to English.
4) The interviews and community focus group are held during a fasting month. As most of the participants are then not allowed to eat and drink anything during the day, their answers might be influenced by the effects of fasting.

Conclusions

This paper presented the preliminary findings of a Master's thesis research project in Geographic Information Science. In particular, the paper explores the current practice of VGI at each of disaster management stages for floods in Jakarta, including their benefits and credibility related issues. The preliminary findings will contribute to filling in the gap in VGI application at each disaster management stage as well to support the development of a framework to improve VGI credibility in disaster management.

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